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ABSTRACT

This is a compilation of instructional materials to assist teachers and students in learning about the metric system. Contents are organized into four color-coded sections containing the following: (1) background and reference materials for the teacher, including a list of available media and a conversion chart; (2) metric activities for primary grades; (3) metric activities for the middle school; and (4) metric activities for high schools. Over 12 activities are included in each of the sections and can be adapted for other instructional levels. Sample activities are making a liter container, treasure hunts, map skills, shopping, and baking. The activities vary in format but generally include a list of materials and procedures. (RG)

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CAREER EDUCATION PROGRAM

RALEIGH CITY

SE 022 386

METRIC EDUCATION COMMITTEE REPORT

The Metric Education Committee was a joint effort between the Salem City School System and the Sending Districts of Lower Alloway's Creek and Mannington.

METRIC EDUCATION COMMITTEE:

Mr. Joseph Blocksom - Salem High School
Mrs. Geraldine Brown - Mannington School
Mrs. Grace Counsellor - Salem High School
Miss Linda L. Groff - Salem City Schools
Mrs. Susanne James - John Fenwick Schools
Mrs. Elizabeth Ponti - Salem Middle School
Miss Charlotte Sweeney - Lower Alloway's Creek School
Miss Gail Weiser - Mannington School

From early times, man has recognized the need for measurement and as man has become more technologically sophisticated, so has his demand for a simple, consistent, and logical system of measurement been increased.

Early measurements were crude and inexact; units of measure being derived from parts of the body or objects in nature. The length of a man's foot, the width of his hand, the capacity of a gourd, and the weight of a large stone were all used to measure objects. Obviously, these units were indefinite and varied significantly from individual to individual and gourd to gourd.

As the amount of trade increased, the need for standard units of measure grew. The older ways of measuring were replaced by standard units; such as, the length of Charlemagne's foot, the distance between King Henry's outstretched middle finger of his right hand and his nose, the width of three barleycorns placed side by side, etc. Again, measurement varied not only from region to region but from country to country; and, in addition, there was no logical relationship from one unit to the other.

Late in the Eighteenth Century, a group of scientists from the French Academy of Sciences developed a new set of units for all measurement -- The Metric System.

The metric system is a decimal system that parallels our numeration system and the units for measuring length, volume, and mass are related one to the other.

The fundamental unit of length is the meter. (A meter is approximately 3-1/3 inches longer than a yard.) Originally, the meter was defined as one ten-millionth of the distance from the North Pole to the Equator. This distance was marked off on a platinum-iridium bar and subsequent measuring instruments were made from this standard. The meter today is defined as 1,650,763.73 wave lengths of orange-red light of excited krypton of mass number 86. At any rate, the meter is the base unit of length.

To this base unit, one need only add prefixes to name other units that are ten times greater than the next smaller unit. The prefix deca stands for tens. A decameter is the length of ten meters. The prefix hecto is used to name hundreds. The hectometer is the length of one hundred meters. The prefix kilo stands for thousands. A kilometer is the length of one thousand meters. These units of measure are greater than a meter.

A base unit of measure is also subdivided into smaller units by using prefixes. The prefix deci stands for tenths. A decimeter is one-tenth of a meter; conversely, there are ten decimeters in one meter. The prefix centi stands for hundredths. A centimeter is one-hundredth of a meter. The prefix milli means thousandths. A millimeter is one-thousandth of a meter.

These six prefixes can be attached to any of the basic units -- the meter, the liter, or the gram.

RELATIONSHIP TO PLACE VALUE

Thousands	Hundreds	Tens	Ones	Tenths	Hundredths	Thousandths
Kilo	Hecto	Deca	Base Unit	Deci	Centi	Milli
1000	100	10	1	1/10	1/100	1/1000
Kilometer Kiloliter Kilogram	Hectometer Hectoliter Hectogram	Decameter Decaliter Decagram	Meter Liter Gram	Decimeter Deciliter Decigram	Centimeter Centiliter Centigram	Millimeter Milliliter Milligram

If you want to change thirty decameters into meters, simply move the decimal point to the right one place (300 meters). If you want to change eight decimeters into meters, move the decimal point to the left one place (.eight meters).

In other words, to convert from a larger unit to a smaller unit, multiply by ten by moving the decimal point one place to the right for each unit change. To convert from a smaller unit to a larger unit, divide by ten by moving the decimal point one place to the left for each unit change.

The gram is the standard unit of weight or of mass (It is about 1/28th of an ounce). A raisin weighs approximately one gram. The gram is related to the meter in that by definition the gram is the weight of one cubic centimeter of pure water. For practical purposes, the kilogram is the unit that we deal with (it is equal to about 2.2 pounds).

The standard unit of capacity of liquid volume is the liter (it is a little over a quart). The liter by definition is the amount of pure water in a one cubic decimeter container. Anything that we now measure in gallons, quarts, pints, or cups will be measured in terms of liters milliliters, etc.

There are seven basic units of measure in the International System of Units (SI), which are the metric standards agreed upon internationally. These are:

Length - Meter

Mass - Kilogram

Time - Second

Temperature - Kelvin (Celsius-0°C Freezing Point
100°C Boiling Point)

Electric Current - Ampere

Molecular Weight - Mole

Luminous Intensity - Candela

The French Scientists developed the Metric System at the time of the French Revolution; however, it was slow to come into common use. In 1837, a law was passed in France making the use of the Metric System compulsory after 1840. Since that time, almost every country in the world has adopted or has committed itself to adoption of the Metric System.

The United States Congress has failed to act on legislation to make metric conversion mandatory. However, many industries are already in the process of converting or have converted to the Metric System. Maryland has announced its intention to change and California will require metric education in the public school system by 1976. Many other states are either studying the problems of metric conversion or are debating bills now pending in their legislatures.

The New Jersey Legislature failed to act on a bill last year. However, on November 7, 1973, the New Jersey State Board of Education passed a resolution that urges

> "New Jersey school districts to initiate a program of instruction in the metric system so that it is the primary language of measurement at all levels of instruction by 1976."

FIGMENTS by Dale Hale
AND IN THE NEXT FEW YEARS WE HOPE THE ENTIRE WORLD WILL BE USING THE METRIC SYSTEM!
WHAT'S GOING TO HAPPEN TO THE INCH WORM?
IT'S A METRIC WORM!
DALE HALE

Metric Education, Kindergarten through Twelve, is upon us, although realistically, our English system of measurement will be with us for some time to come. Consequently, at first, both systems will need to be taught. In a sense, students should become bilingual in measurement -- their primary language being metric; their secondary language the English system.

In order to get students to think in any measurement system, they must be able to visualize distances and volumes, and estimate weights. Having students estimate the length, the weight, the temperature, or the volume before they actually measure it is very important to their internalizing what measurement really is. Estimating and manipulating measurement instruments seem to be the key to students gaining a working, thinking knowledge of measurement systems.

It should be emphasized that requiring students to convert from one system to the other will be a deterrent to the basic goal of getting them to <u>think metric</u> and thus any conversion from system to system should be discouraged.

However, what should be encouraged is the active involvement of students in the use of metric measurement tools. The remaining three sections of this report consist of some examples of activities suitable for the primary, middle, and high schools. These activities and others similar to them should be helpful in making metric the primary language of measurement for our students and ourselves.

SCOPE AND SEQUENCE

	Length	Mass	Capacity	Area	Volume
Phase I	meter centimeter	kilogram gram	liter		
Phase II	kilometer meter centimeter	kilogram gram	kiloliter liter		
Phase III	kilometer meter centimeter millimeter	kilogram gram milligram	kiloliter liter milliliter	square meter square centimeter	
Phase IV	kilometer meter centimeter millimeter	kilogram gram milligram	kiloliter liter milliliter	square meter square decimeter square centimeter square millimeter	cubic meter cubic centimeter
Phase V	kilometer hectometer meter decimeter centimeter millimeter	kilogram gram milligram	kiloliter liter milliliter	square meter square decimeter square centimeter square millimeter	cubic meter cubic decimeter cubic centimeter
Phase VI	kilometer hectometer meter decimeter centimeter millimeter	kilogram hectogram dekagram gram milligram	kiloliter liter milliliter	square kilometer square hectometer square meter square decimeter square centimeter square millimeter	cubic hectometer cubic meter cubic decimeter cubic centimeter cubic millimeter

Additional prefixes related to base units:
tera-, giga-, mega-, micro-, nano-, pico-, femto-, atto-.

Temperature measure is introduced in Phase II and developed throughout.

Underlined words are introduced at that Phase and reinforced throughout.

AVAILABLE MEDIA MATERIALS

SLIDES - Think Metric: Understanding and using the Metric System. Dencyer-Geppert. Audio-Visuals, 1973.

FILMSTRIP/CASSETTE - The Metric System: The Universal Language of Measurement. Pathescope Educational Vocational Films, 1971.

1. An Introduction To The Metric System
2. Metric Units Of Length
3. Metric Units Of Area And Volume
4. Metric Units Of Mass
5. Metric Units Of Capacity
6. Metric Units In The Science Laboratory

TRANSPARENCIES - The Metric System. 3-M Company, Visual Products Division.

DUPLICATING MASTERS - The Metric System. The Instructor Publications, Inc., 1973.

BOOKS - Discover Why Metrics. Roscoe, Illinois: Swani Publishing Company, 1972.

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Are You Ready for Meters, Liters, and Grams?

By MARION MARTIN
Gannett News Service

WASHINGTON—How's your knowledge of meters, liters and grams—not to mention degrees Celsius?

First of Three Parts

If you're one of many who gripe about the suddenness of the energy shortage you'd do well to prepare now for another change in the marketplace and your home — metric conversion.

America is switching, slowly but surely, say government and industry officials, from its traditional pound-inch system of measurement to metric, the system now used by most of the world.

The changes are happening, however, in a way that could leave the average consumer asleep at the switch.

Big manufacturers that trade with predominantly metric foreign countries—General Motors, IBM, 3M, International Harvester, for example—are all converting to metric. But the consumer may not realize, or care, that his car is being serviced with a metric socket wrench.

American children may be converted to metric, too, long before adults. Schools across the country are stepping up their teaching of the metric system. States such as California and Maryland are planning new programs of metric instruction.

It would help if Congress would pass proposed legislation paving the way for a co-ordinated plan for conversion.

There were high hopes for passage of a conversion bill in the last session, but emergency consideration of energy legislation and opposition from labor and small business interests delayed action.

The proposed legislation would set up a board, appointed by the President, to create a voluntary nationwide conversion plan. Neither the Senate bill nor the similar House bill provides for subsidies to businesses or workers for any equipment or retraining costs, however, and labor and small business object to this.

Backers of the conversion legislation believe it has a good chance of passing in the new session of Congress, although they concede it is not a high priority measure.

But even if Congress does not act, they endorse the conclusion of the Department of Commerce's massive three-year study of metric conversion: it's a decision whose time has come.

"Anything government does now is anticlimactic," said an educator.

Metric conversion is inevitable, said a businessman.

"It's happening right now," said a government measurements expert.

Why change? If pounds and inches were good enough for past generations of Americans, why aren't they good enough for us?

More profitable international trade is the big reason for going metric, Commerce Department officials say. The United States is an "island in a metric world."

During the last quarter-century, the metric system has become "the dominant language of measurement throughout the world," said Betsy Ancker-Johnson, assistant secretary of commerce for science and technology.

Great Britain and Canada are in the midst of conversion. Japan has also converted. Only the U.S. and a few small nations remain uncommitted to metric. And American business and industry are faced with the expense of making products in one set of measurements for the domestic market and another set for foreign trade.

Another reason for metric conversion that more directly affects the consumer is this: it's an easier system to use, according to experts at the National Bureau of Standards who say that metric is simpler because it's based on decimals.

You can figure metric units by tens, just as our currency is figured. This eliminates the need for the odd fractions of our traditional system of measurement.

Even the metric terms come in a set of ten. "For everyday use," says the Bureau of Standards, "you will need to know only ten units."

These are meter, millimeter, centimeter, and kilometer for measuring length; gram, kilogram and tonne for weight; liter and milliliter for volume; and hectare for area.

"You'll also need to get to know a few new temperatures," says NBS, in degrees Celsius. If you once learned the metric temperature measure as Centigrade, forget it; Celsius is now the accepted term.

Although educators and government experts want you to learn to "think metric" rather than spend much time in converting familiar measurements to the new system, here are some approximate conversions you will need to know for starters:

Meter: 1.1 yards
Centimeter: 0.4 inches
Kilometer: 0.6 miles
Gram: 0.035 ounces
Kilogram: 2.2 pounds
Tonne: 1.1 tons
Liter: 1.06 quarts
Milliliter: 0.03 fluid ounces
Hectare: 2.5 acres

You'll need to get used to new temperature figures: Water boils at 100 degrees Celsius 212 degrees Fahrenheit; it freezes at 0 degrees C. 32 degrees F.; your normal body temperature is 37 degrees C. 98.6 degrees F.; and a warm winter weather prediction is for 18 degrees C. 50 degrees F.

And remember, too, that our termed "English" system isn't sacred or even logical. It's variously traced to the ancient Romans and to an English king who used his own large foot as a standard of measurement.

The metric system is no newfangled idea, either. Developed by the French Academy of Sciences in the 1790s, it was legalized by the U.S. Congress in 1866 and "officially" adopted by the Secretary of the Treasury in 1893.

Metric America

Instead of 34–24–34

It Will Be 85–60–85

By MARION MARTIN
Gannett News Service

WASHINGTON—Are metric measurements creeping up on you? The shift in measurement of consumer products is happening so slowly and haphazardly, say home economists and government officials,

Second of Three Parts

that the average consumer may not realize that some products already come in metric measures.

For example, prescription drugs and photographic equipment have been sold in metric measures for some time. Other products—some canned and packaged foods, most sewing patterns — have dual measures, both customary pound-inch and metric. Even illegal marijuana sales are by the "kilo" or kilogram. New government-recommended nutrition labeling will be in metric measures.

Most consumer products will eventually come in metric sizes if the current trend continues, say experts. "Eventually" will be a lot sooner with a government-backed co-ordinated plan, they add.

Home Economists

Home economists have been preparing for a "metric America" for some time. The American Home Economics Association, which went on record in favor of metric conversion in 1967, has members at work developing standards for new home equipment in metric measures.

Margaret Warning, Iowa State University home economist and chairman of an AHEA metrication committee, says even though the standards are still in the talking stage, manufacturers "are going ahead right away" with metric products. A "metric-cup" of home products with dual measures at Iowa workshops.

AHEA is also developing metric lessons for secondary schools and extension classes. The association has a "metric person" in every state helping with questions on conversion.

AHEA members also contributed to the Commerce Department's voluminous metric study, which examined effects of conversion on every phase of American life.

The Picture

Here's the picture, based on the "metric America" the home economists foresee:

In your "a metric" home, you'll have an array of converted measurements. You'll weigh yourself in kilograms, not pounds, on a metric scale. You'll check your thermostat for house temperature in degrees Celsius, not Fahrenheit. Your cooking and freezing temperatures will also be measured in degrees Celsius.

You'll be adapting your recipes to metric measures. However, say home economists, if new standard metric measuring cups, spoons and pans are produced, you'll be able to use old recipes. The proportions will be slightly larger, but the ratio of ingredients will remain the same.

The difference between today's measuring cup (237 milliliters) and the proposed standard metriccup (250 millilites) is not great, home economists say, and measuring by volume, traditional with American cooks, is not all that accurate. Although they doubt that Amerian cooks will want to switch to weighing ingredients, as cooks in some foreign metric countries do, measuring by weight is much more accurate.

Milk by Liter

You'll be purhasing milk by the liter, instead of the quart or gallon. A liter of milk will be slightling larger — 1.06 quart. You'll be buying your meat and staples by the gram and kilogram. A one kilogram steak weights 2.2 pounds. A 500-gram can of coffee weighs 1.1 pounds.

These new measures will be an advantage to the shopper, home economists maintain, because the present confusing variety of measures — avoirdupois ounces and pounds, dry and liquid quarts, bushels, packs, etc. — will be reduced to a simple system. If package sizes are also standardized, unit pricing won't be necessary. You'll easily compare prices, using decimal-based metric units.

Clothing Sizes

Clothing sizes will also become easier to judge and more accurate under the metric system. Home economists envision a method of sizing by body measurement for men, women and children. It won't be flattering. A woman measuring trim 34-24-34 in inches comes out 85-60-85 in metric centimeters.

But a worldwide system of standard clothing sizes would be a boon to consumers everywhere. "It's also annoying to overseas travelers that they can't buy clothing gifts in recognizable sizes," says Iowa's Dr. Warning.

Home sewers will have to adopt to new metric measures, too. They'll buy yardage by the meter and begin using metric tape-measures. You'll also buy home furnishings with new measurements. But carpeting, now measured by the foot yet sold by the yard, should be easier to buy by the meter.

Road Signs

You'll face metric changes on the road, too. But the changeover to metric could provide an opportunity for more uniform road signs. Motorists in Ohio are already learning to read kilometers instead of miles, since that state has begun dual marking of road signs on some highways.

Will consumers adapt happily to a "metric America"? Authorities are afraid not.

"The big handicap is that people don't like to change," says Dr. Warning.

"The greatest problem is not in the psychological difficulty of adjusting to something unfamiliar," Doris Hanson, AHEA director, told a Senate committee hearing.

The AHEA and Commerce Department officials agree that there needs to be a "well-organized, co-operative effort" by government, business, the news media and consumer organizations to get the metric message across.

The secret weapon that metric boosters are relying on in the long run, however, is the one now reaching a future generation of consumers — America's schools.

Thursday: Our schools are "thinking metric."

Metric America

Young 'Missionaries' Spread the Word

By MARION MARTIN
Gannett News Service

WASHINGTON — Have you seen a car with a "Think Metric" bumper sticker? It may belong to your child's math teacher.

The nation's educators are a strong force in the movement to switch to the metric system. And they believe the best way to learn the system is early, and from scratch.

This means that children will be taught from the beginning to measure with the

Last of Three Parts

metric system, not to convert from the customary "pound-inch" system.

As early as kindergarten, predicts an official of the National Council of Teachers of Mathematics, pupils will learn to measure their height in meters and centimeters, not feet and inches.

Joseph R. Caravella, NCTM director of professional services, sees a time not too far off when children will be learning our customary system of measurement as a footnote to metric measurement, the reverse of the way their parents learned to measure.

'Think Metric'

Ideally, says Caravella, children soon will be learning to "think metric" in all subject areas, not just in math or in science where metric is already used. English and history classes will get involved in the new words and the story behind them. Vocational and home economics classes will also have to "think metric." Even physical education classes will have new metric statistics to contend with.

Caravella thinks elementary school children will act as "metric missionaries," helping refresh their parents on the metric system.

NCTM, which has some 50,000 members across the country, has officially backed the switch to metric, as have the National Education Association and the National Science Teachers Association. It's simpler and more universally used, they reason.

Board Game

NCTM has a large display of metric materials — tapes, books, conversion devices, even a "Metrication" board game — in its national center at Reston, Va., an indication that educational product companies are on the metric bandwagon.

States and localities are moving to adopt metric the predominant system taught in their schools. California will switch to metric in the fall of 1976. Maryland is beginning a six-year changeover this fall.

More than half the states are now committed to some type of switch to metric teaching, Caravella estimated.

It's the educated "guess" of National Bureau of Standards metric information officer Jeffrey Odom that "fifteen years from now we'll have the reverse of what we have now" in the teaching of measurement — heavy emphasis on metric over our present pound-inch system.

'Rule of Reason'

"We can't ignore the old system," says Odom, who said a "rule of reason" will govern many changes to metric. When youngsters head for the football field, it will probably continue to be marked off in yards and not meters. The customary system of measurement will still be around *where* conversion would be too cumbersome or expensive. Property deeds will retain in their old language, for example. And you can still sing, "Five-foot two, eyes of blue." But your children will be speaking a new language, and educators hope you'll learn it along with them.

Parental Support

Educators want to enlist parental support for metrication. The NEA has suggested ways parents can help their children and themselves:

—Start using a meterstick at home instead of a yardstick.

—Buy metric when you replace kitchen measuring cups and spoons, bathroom scale, garden and house tools.

—Insist that the new textbooks your school buys give good coverage of the metric system.

—Insist that classrooms, especially elementary school ones, have metric measuring equipment.

—Consider brushing up on the metric system yourself through your local adult education program.

A joke going the rounds of the math classes might sum up the belief of the educators:

Q. Why didn't the yardstick?

A. Because it didn't quite measure up to the meter.

All You Will Need to Know About Metric

(For Your Everyday Life)

10

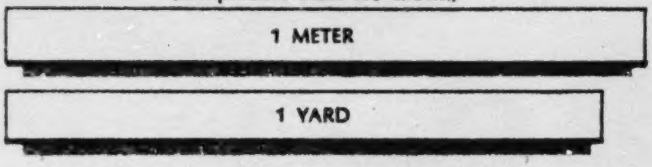
Metric is based on Decimal system

The metric system is simple to learn. For use in your everyday life you will need to know only ten units. You will also need to get used to a few new temperatures. Of course, there are other units which most persons will not need to learn. There are even some metric units with which you are already familiar: those for time and electricity are the same as you use now.

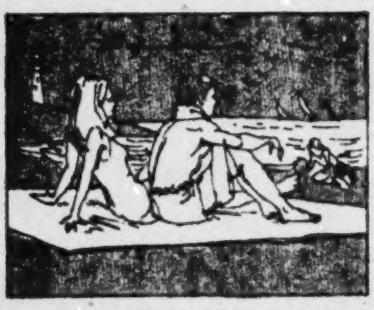
BASIC UNITS

METER: a little longer than a yard (about 1.1 yards)
LITER: a little larger than a quart (about 1.06 quarts)
GRAM: about the weight of a paper clip

(comparative sizes are shown)



25 DEGREES FAHRENHEIT



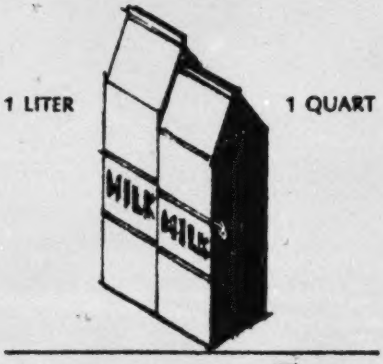
25 DEGREES CELSIUS

COMMON PREFIXES

(to be used with basic units)

Milli: one-thousandth (0.001)
Centi: one-hundredth (0.01)
Kilo: one-thousand times (1000)

For example:
1000 millimeters = 1 meter
100 centimeters = 1 meter
1000 meters = 1 kilometer

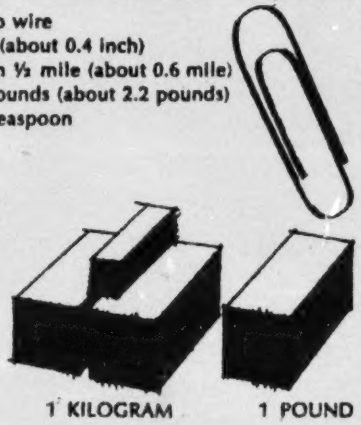


OTHER COMMONLY USED UNITS

Millimeter:	0.001 meter	diameter of paper clip wire
Centimeter:	0.01 meter	width of a paper clip (about 0.4 inch)
Kilometer:	1000 meters	somewhat further than ½ mile (about 0.6 mile)
Kilogram:	1000 grams	a little more than 2 pounds (about 2.2 pounds)
Milliliter:	0.001 liter	five of them make a teaspoon

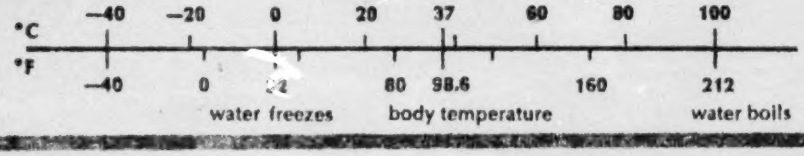
OTHER USEFUL UNITS

Hectare: about 2½ acres
Tonne: about one ton



TEMPERATURE

degrees Celsius are used



For more information, write to: Metric Information Office, National Bureau of Standards
Washington, D.C. 20234

APPROXIMATE CONVERSIONS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in.	inches	2.5	centimeters	cm
ft.	feet	30	centimeters	cm
yd.	yards	0.9	meters	m
mi.	miles	1.6	kilometers	km
mm	millimeters	0.04	inches	in.
cm	centimeters	0.4	inches	in.
m	meters	3.3	feet	ft.
m	meters	1.1	yards	yd.
km	kilometers	0.6	miles	mi.
		AREA		
$in.^2$	square inches	6.5	square centimeters	cm^2
$ft.^2$	square feet	0.09	square meters	m^2
$yd.^2$	square yards	0.8	square meters	m^2
$mi.^2$	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
cm^2	square centimeters	0.16	square inches	$in.^2$
m^2	square meters	1.2	square yards	$yd.^2$
km^2	square kilometers	0.4	square miles	$mi.^2$
ha	hectares (10,000 m^2)	2.5	acres	
		MASS		
oz.	ounces	28	grams	g
lb.	pounds	0.45	kilograms	kg
	short tons (2000 lbs.)	0.9	tonnes	t
g	grams	0.035	ounces	oz.
kg	kilograms	2.2	pounds	lb.
t	tonnes (1000 kg)	1.1	short tons	

APPROXIMATE CONVERSIONS (Continued)

Symbol	When You Know	Multiply By	To Find	Symbol
		VOLUME		
tsp.	teaspoons	5	milliliters	ml
Tbsp.	tablespoons	15	milliliters	ml
fl.oz.	fluid ounces	30	milliliters	ml
c.	cups	0.24	liters	l
pt.	pints	0.47	liters	l
qt.	quarts	0.95	liters	l
gal.	gallons	3.8	liters	l
$ft.^3$	cubic feet	0.03	cubic meters	m^3
$yd.^3$	cubic yards	0.76	cubic meters	m^3
ml	milliliters	0.03	fluid ounces	fl.oz.
l	liters	2.1	pints	pt.
l	liters	1.06	quarts	qt.
l	liters	0.26	gallons	gal.
m^3	cubic meters	35	cubic feet	$ft.^3$
m^3	cubic meters	1.3	cubic yards	$yd.^3$
		TEMPERATURE (exact)		
$^oF.$	Fahrenheit temperature	5/9 (After subtracting 32)	Celsius temperature	^oC
^oC	Celsius temperature	9/5 (Then add 32)	Fahrenheit temperature	$^oF.$

METRIC ACTIVITIES

The following three sections are suggested metric activities for the primary school, middle school, and high school in that order.

Activities in one section can be adapted to other levels.

STUDENT PHYSICAL GROWTH CHART

Students will have individual growth charts to record their height and weight at two-month intervals.

It is suggested that a class wall chart be utilized in the primary grades and individual growth charts be used in the upper elementary grades.

Day	Weight		Height	
	kg	pounds	cm	ft./in.
September				
November				
January				
March				
May				

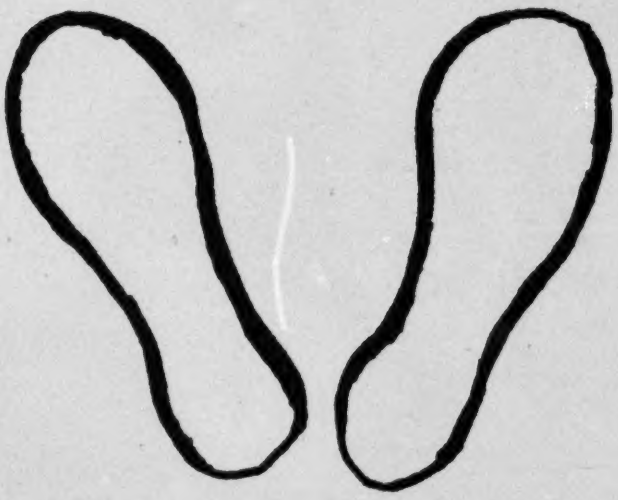
SHOE MEASUREMENT

Have students measure the length of their shoes in centimeters.

Using their feet as a measuring instrument, have them measure the length and width of the classroom, hallway, play yard, etc.

Have students change centimeter distances into meters (100 centimeters equals One Meter).

Discuss other ways of more accurately measuring these distances.



HAVE STUDENTS DRAW THE FOLLOWING PICTURES:

1. A boat - fifteen centimeters long.

2. A building - nine centimeters high.

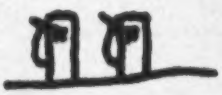
3. A car - eight centimeters long.

4. A picket fence - seven centimeters long.

5. A television set - three centimeters high and four centimeters long.

6. A train - fourteen centimeters long.

7. A service station - eleven centimeters long and six centimeters high.



FOOT RACES

Make adjustments in distances to the age and the ability of the students.

Materials:

Trundle Wheel, Meter Stick, or Measuring Tape
Small Stakes
Ribbon
Record Sheet
Stop Watch
Oaktag

Procedure:

Have students measure 10 m, 25 m, 50 m, 100 m distances. Mark the distances with stakes.

Time students running
walking
walking backwards
jumping
skipping
wheelbarrow
Etc.

Class Record

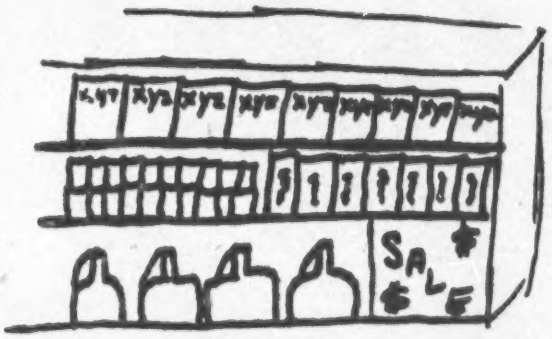
Date_____

Student's Name	Running	Walking	Jumping

WALKING TOUR OF A SUPERMARKET

Take your class on a walking tour of a local supermarket. Instruct children to look for any item which has been weighed or measured metrically. Each child should have a notebook in which he can list the item and its weight or volume (grams and liters).

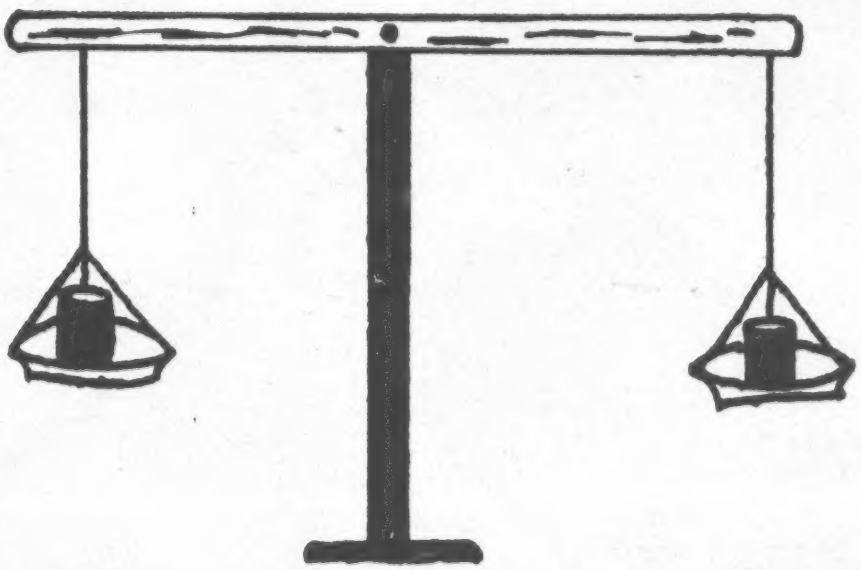
Children should also be encouraged to bring in containers from home which show metric weight and volume. These containers should be displayed in the classroom.



ESTIMATING WEIGHT

Materials: Balance beam or scales
2 coffee cans
marbles, sand, water, candy

1. Fill one coffee can with marbles.
2. Ask students to lift coffee can and then fill the other can with either marbles or sand to approximate the same weight.
3. When they have finished their quesses, have them either weigh each can or use the balance beam.
4. If their estimates are inaccurate have them add or detract depending on whether they are over or under weight.
5. When the weight balances, let students hold both cans in their hands.
6. Repeat process with other objects.



Catching Up With the Rest of the World

Materials:

Meter Stick
Metric Tape Measure
Notebook

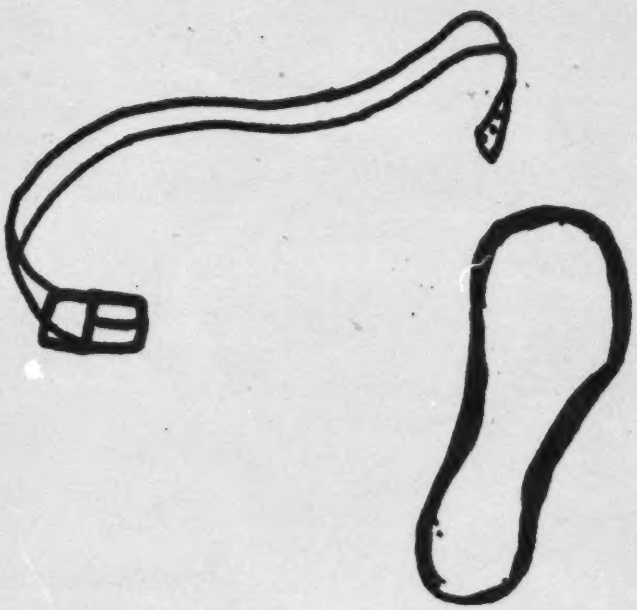
Procedure:

Every day list three items in the classroom for children to measure. Have them enter the name of the item and its measurement in a notebook.

This activity can also be extended to the outside world. Children should also list these items in their notebooks.

Ask each child to wear a belt to school. Spend time measuring each other in centimeters. First wrap around waist, then measure belts. Compare size of belt to actual length.

Repeat with shoes. Make a chart in sizes and centimeters of everyone. Trace their own foot on the chart. Find what is the most popular measurement and/or size.

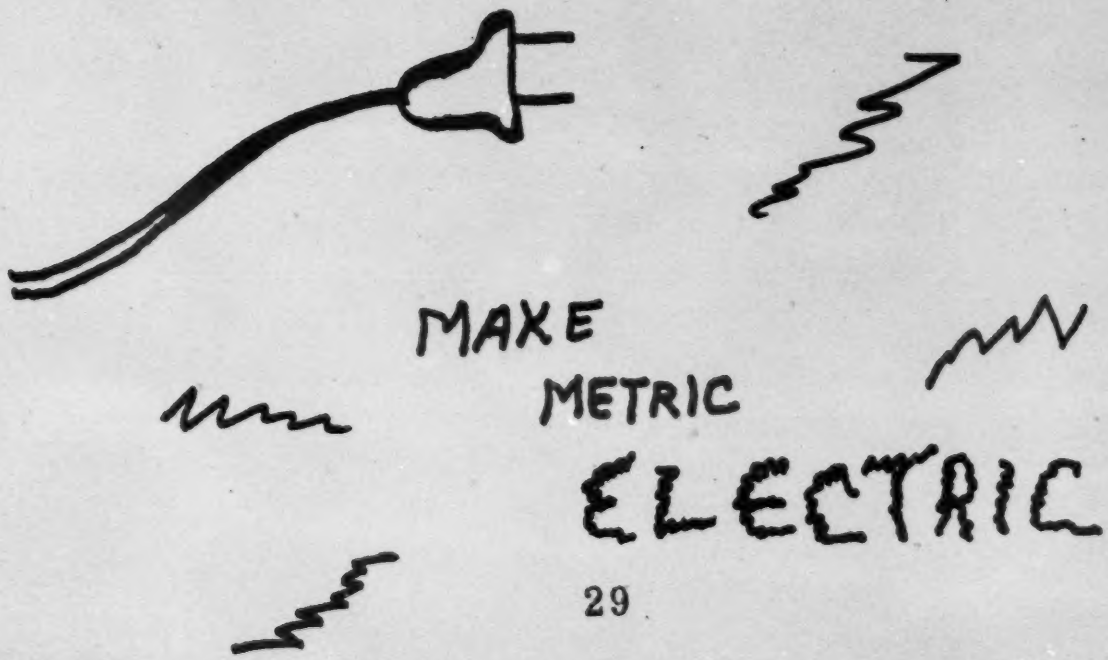


ESTIMATE AND MEASURE: CENTIMETER

Materials:

Meter Tape or Meter Stick
Electric Plug
Comb
Eraser
Pencil
Fingernail
Shells
Various other objects whose height, length, or width equals about one centimeter.

A centimeter is about the thickness of an electric plug. Choose five objects that you estimate to be a centimeter in height, length, or width. Then check by measuring with the meter stick or tape.



Holidays

Halloween

pumpkin pie recipe
weigh candy

Thanksgiving

weigh cranberries
weigh turkey

Christmas

weigh candy
length of ribbon
size of wrapping paper
string popcorn - lengths in centimeter

Valentines

postal system - weigh cards
on balance scale

Easter

egg dying - How many litres of water
to one drop of dye?

Spring

Begin seeds growing and measure plants by millimeters and centimeters. Keep records by groups of two of growth.

MAKING A LITER CONTAINER

Materials:

Plastic container such as Clorox Bottle
Scissors
Indelible Magic Marker

(One cubic decimeter will contain a liter of water.)

Procedure:

Step 1: Fill a cubic decimeter with water.

Step 2: Pour water into the container.

Step 3: Mark the container with the magic marker at the water line.

Step 4: Empty out water.

Step 5: Cut the container an inch and a half or two inches above the waterline.

Step 6: Mark inside of container.

"MIX - A - METER"

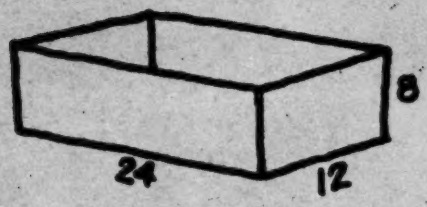
This game is designed to teach the relationships between metric units of length.

You will need to make thirty playing cards. (File cards work well for this.) Using a colored marker, label nine of the cards 1 dm (decimeter) through 9 dm (one on each card). Using another color, label nine cards 10 cm (centimeters) through 90 cm. And in a third color, label nine cards 100 mm (millimeters) to 900 mm. Each of the three remaining cards is labeled "Wild Card."

Two, three or four students can play. Deal five cards to each player and place the rest in a pile on the table. The player to the right of the dealer takes the card from the pile and tries to "make" a meter by combining two of the six cards he is holding. At the beginning, have the students try to combine only like units, such as 200 mm and 800 mm or 90 cm and 10 cm. A wild card can have any value. When the children become familiar with the game, they can combine different units such as 3 dm (equals 30 cm) and 70 cm. Another variation is to allow more than two cards to be used to make the meters. When a meter is made, it is placed on the table and counts one point.

A discard must be made after each draw and the next player has the option of picking up the discard or taking the next card on the pile. Continue play until one player is out of cards. If the pile is exhausted before a player is out, shuffle the discards and use them as a new pile.

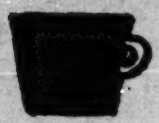
"KILOGRAM" CAKE



Grease and line with paper:
24 x 12 x 8 centimeter loaf pan (which will replace our old 9 x 5 x 3" pan)

Sift together into bowl:

½ kilogram flour (2¼ cups)



¼ kilogram sugar (1 cup)

10 grams baking powder (2 tsp.)

5 grams salt (1 tsp.)

Add:

½ kilogram soft shortening (½ cup)

5 milliliters vanilla (tsp.)

5 egg yolks

110 milliliters milk (½ cup)

Beat two minutes then add:
55 milliliters of milk (¼ cup)

55 milliliters of milk (¼ cup)

Spoon batter into prepared pan. Bake 60-70 minutes in a moderate oven: 185° Celsius. Cool and ice with orange glaze.

U.S.A. Goes Metric
Swani Publishing Company
Post Office Box No. 248
Roscoe, Illinois 61073

TRUNDLE WHEEL ACTIVITIES

Materials:

Trundel Wheel
(Instructions for construction available)
Meter Stick

Using the trundle wheel, measure lengths and widths for diameter area and circumference.

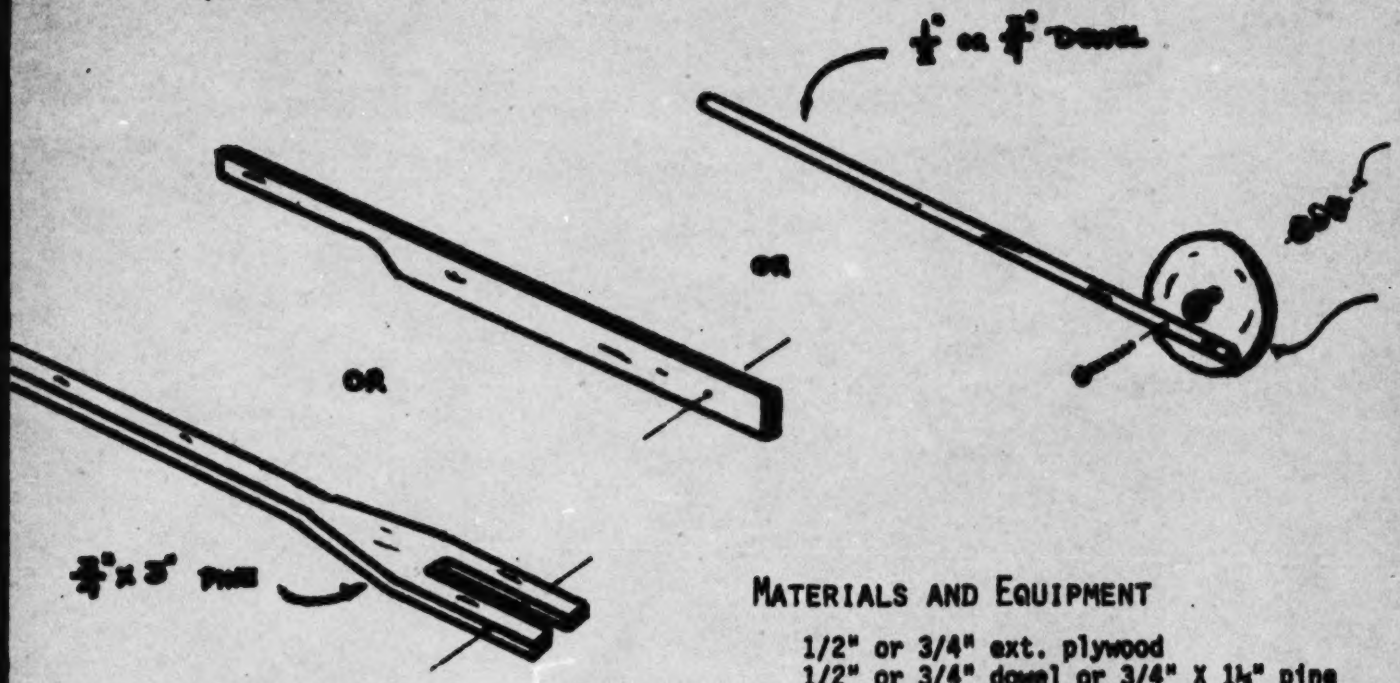
Examples:

Classrooms
Restrooms
Offices
Halls
Playground
Basketball Court
Baseball Diamond
Foul Circle
Driveway

Note:

1. Meter stick may be used beginning and ending of measuring with Trundle Wheel as the wheel will not operate accurately against a wall.
2. Beware of the Trundle Wheel slipping on smooth surfaces.

TRUNDLE WHEEL HANDLE IDEAS



MATERIALS AND EQUIPMENT

1/2" or 3/4" ext. plywood
1/2" or 3/4" dowel or 3/4" X 1½" pine
Machine bolt, nut
Lock and flat washer for axle
Pencil
Graph paper

Dremel Saw
Sabre Saw
Hand Saw
Hand Drill - 1/8", 1/4" 5/16" bits
Claw Hammer
Screw Driver
Compass
Trammel points

PROCEDURE:

1. Decide on a metric or english unit or build and compare both.
2. Determine the size of your wheel. Select 1/2" or 3/4" exterior plywood for the wheel.
3. Layout and cutout the wheel.
4. Design, build and attach a means for holding and controlling the wheel.
5. Check the accuracy of your wheel, correct circumference if necessary.

WHICH MEASUREMENT WOULD YOU USE?

After having discussed the correct metric measurements to use for length, area, mass, volume, and temperature make up a work sheet and let the children decide the correct measurement to use.

Example: Circle the correct measurement to use with each item.

Candy (grams) meters liters

Milk meters kilometers (liters)

Salem to Pennsville

grams meters (kilometers)

Canoe Trip

Materials:

Students
Metric Bathroom Scales
Life Preservers

You are running the rapids of Wading River in New Jersey's Wharton's Tract. Your rubber raft can hold 300 kilograms. How many friends can go with you? Don't forget each person must wear a life jacket. Good luck!

Packing For A Round-The-World Trip

You have just won a fantastic trip around the world! You will only be allowed to have twenty kilograms of luggage. You plan to buy and bring home five kilograms of souvenirs. Choose wisely the items you think you will need for your trip. Don't forget you are only allowed to take twenty kilograms on the plane. Also, remember you will be returning with five kilograms of souvenirs.

Materials:

Clothing
Toilet Articles
Suitcase

SOIL CONSERVATION

Materials:

Planters made from our gallon-sized plastic jugs
cut in half lengthwise
Four types of soil -- sandy, loam, clay, shale
Grass Seed
Graduated liter measure
Sprinkling can
Eight Catch Basins such as pint jars; strainer

Procedure:

Fill the eight planters with the four soil types (two jugs per soil type). Plant grass seed in one planter of each soil type -- that is, one sandy soil will have grass, one sandy soil will not; one clay soil will have grass, one will not; and so on. Care for the grass seed so that it will sprout and grow. Care for the barren soils in the same manner so that conditions remain constant.

After the grass seed has sprouted, place all eight planters so that a catch basin is under the spout of each. Be sure that the backs of the planters are at the same height. Fill the sprinkling can with one liter of water and gently sprinkle the soil in one planter. Repeat this procedure with each of the other planters, keeping the rate of water on each planter. When water ceases to drip from each planter, remove the catch basin, strain the water, and record how much water runoff occurred.

Discuss how much water ran off each soil. Which soil absorbs the most water? Why? Which planter lost the most soil? Why? Where did the most erosion occur? Change conditions (slope of planters, amount of grass), repeat the experiment, and compare the results. Does the data remain the same? How would erosion affect the ecology of an area? How can erosion be prevented? Is erosion the only result of an excess of water in a saturated soil?

Sample of the type of activity found in METRIC MEASUREMENT: ACTIVITIES AND BULLETIN BOARDS.

ESTIMATE AND MEASURE: DECIMETER

Materials

Meter Stick
Cans of Soup
Books
Cards
Cups
Silverware
Various other objects whose height, length, or width equals about one decimeter

A decimeter is about the height of a can of soup. Choose Five objects that you estimate to be a decimeter in height, length or width.

List the objects. Then check by measuring with the meter stick.

	Objects	Measurement
Sample:	Math Book width	One Decimeter
	Spelling Book height	Too Long
1.		_____
2.		_____
3.		_____
4.		_____
5.		_____

ROOM BY ROOM TREASURE HUNT

Materials:

Metric Tape Measure
Paper

Procedure:

Give children a metric tape measure and a specific measurement. Example: 10 centimeters.

Instruct the children to pick a certain room in their home (excluding kitchen) and find as many objects as they can that measure ten centimeters.

These objects should be listed on paper and brought back to school. Review the lists with the class and check for duplicates and most unusual object measured.

PACKING FOR A WILDERNESS HIKE

Materials

1. Camping foods (soup, dried fruit, package of pancake mix, etc.)
2. Toilet articles (Soap, toothpaste, toothbrush, comb, brush, bandaids, etc.)
3. Camping clothing (sturdy shoes, pajamas, sweater, rain gear, socks, hat)
4. Sleeping bag, traps, bow and arrow
5. Knap Sack
6. Foolish things (record player, glass dishes, evening bag, etc.)
7. Metric Scales (balance and household scale)

Pretend you are going on a week-long hike through the Jersey Pine Barrens. You can only carry ten kilograms in your Knap Sack. Choose wisely what you think you will need to survive in the wilderness.

Remember - you can only carry ten kilograms.

Christmas List

This year make your Christmas list showing clothing sizes using both metric and English systems.

Example:

Item	Person	English Size	Metric Size
Sweater	Aunt Rose	36	

LET'S GO SHOPPING

Have children bring into the classroom as many empty cartons, cans, etc., from the store as they can that have metric (grams) weights.

Set up a grocery store.

Pretend to shop.

1. Total up the metric weights and add.

2. Enter prices to add also.

3. Use balance scale to weigh other articles and put your own weight on it using stickers.

Set up old toys, articles. Shop and weigh these. Put weight on.

1. How many cents per kilogram?

Materials:

Pegboard
Pegs
Yarn - different colors

Procedure:

Step 1: Put various lengths of yarn on pegs on pegboard.

Step 2: At various times during the day, have students measure these lengths and record on paper.

Step 3: Total at the end of the week.

Step 4: Change centimeters to meters or decimeters.

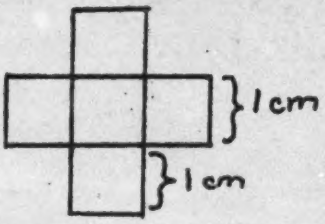
ONE CUBIC CENTIMETER

Materials:

Oaktag
Saran Wrap
Glue
Scotch Tape
Medicine Dropper
Balance Scales
Small Beads

Procedure:

Step 1: Measure and draw the figure below



Step 2: Glue plastic wrap to oaktag. Let dry.

Step 3: Cut out the figure and fold on dotted lines to form a one cubic centimeter container.

Step 4: Fasten the corners with scotch tape.

Step 5: Using the medicine dropper, count the number of drops it takes to fill the box.
How big is a drop?

Step 6: Using the balance scale, weigh the container of water (One cubic centimeter of water weighs approximately one gram).

Step 7: Repeat the process with small beads or other small object. Compare.

Unscramble the measurement words

Metric System		Our Way	
1. terme	_____	1. spound	_____
2. ogirlakm	_____	2. aryd	_____
3. rtile	_____	3. ratqu	_____
4. lokimeters	_____	4. msile	_____
5. lllliimster	_____	5. puc	_____

Matching Words

How would you state our way of measuring in Metric Terms? Draw a line to match the terms.

Our Way	Metric System
miles	meters
quart	kilometers
pounds	kilograms
cup	liters
yard	milliliters (250)

SELLING POPCORN

Materials: Popcorn
Popcorn Popper
Oil
Salt
Baggies
Balance Scale

Procedure:

Have children make popcorn to sell to other classes. Each bag of popcorn should weigh 10 grams. Have children weigh and bag the popcorn. The class may decide an appropriate price to charge for the popcorn.

CLASSROOM TREASURE HUNT

Conduct a classroom treasure hunt by giving students cards with metric lengths written on it and spaces where they can write the objects they find which measure these lengths or nearly these lengths.

25 cm	_____
30.5 cm	_____
508 mm	_____
215 mm	_____

This may also be a daily activity giving the class only one or two lengths to find.

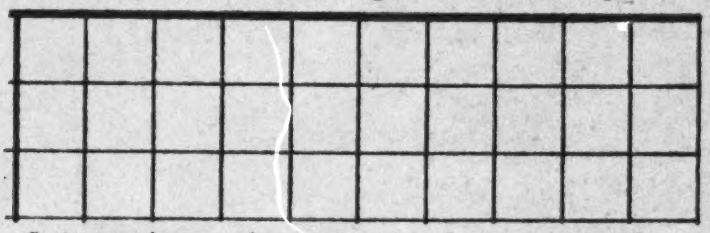
ESTIMATING AREA

Materials:

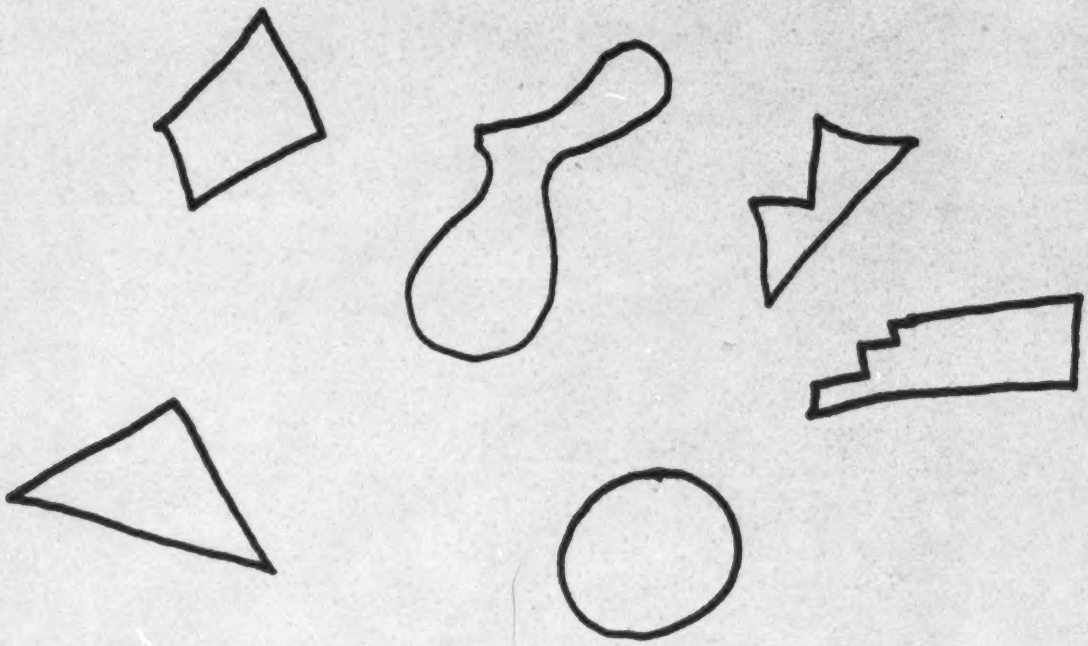
Tracing Paper or other thin paper
Cm Ruler
Pieces of construction paper

Procedure:

Step 1: Make a grid by drawing ten parallel lines one centimeter apart across the paper and ten parallel lines one centimeter apart down the paper. Each square in this grid is one square centimeter.



Step 2: Cut various shapes out of construction paper. Place these under the grid and estimate the area of these figures.



High School Math Dept.

A lesson on the history of the metric system. The pros and cons of converting could be handled as a debate between students, so that all understand what it means to various industries and citizens to convert, but appreciate the advantages of the metric system.

Several film strips, cassettes, and slide sets are available in the L.R.C. Magazines also provide a wealth of materials.

Metric graph paper can be used throughout the department, but not exclusively, unless it can be obtained in squares of less than 1 cm. on a side. It is ideal for general math and simpler algebraic graphs, also geometric figures.

A lesson on the Bureau of Weights and Measures, its history, work, and location.

High School Math Dept.

Actual Weight and Measurement

Have students measure things in the room--like the door, window, desk. Put up permanent labels indicating measurement of permanent objects. Find areas, perimeters, and volumes where appropriate.

Weigh books, chalk of various lengths.

Weigh a cubic decimeter of various things like cereals, dog food, sugar, etc.

Have students measure each other's heights in meters.

MAP SKILLS

You have just won a trip to Europe. You will be visiting the capital cities of France, Germany, Spain, and Italy. The trip will take twenty-one days leaving March 12 from Kennedy International Airport in New York City.

Measure the kilometers from New York City to each capital city.

Find the total number of kilometers traveled.

High School Math Dept.

Teacher-made problems will be stated in metric units.

i.e. Find the perimeter of a rectangle whose length is 5.3 m. and whose width is 2.7 m.

How many hectares are in a field which measures 250 m. by 125 m.?

Note: It is not our intention to convert problems in the books to the metric system.

Addition Activity

1. Cut lengths of yarn or string.
2. Have students measure each in yards, feet, and inches. Total.
3. Have students measure each in meters, decimeters, and centimeters. Total.
4. Discuss relative ease of addition in the two systems.

High School Math Dept.

Bulletin Boards

In classrooms, Learning Resource Center, and halls during "Metric Week" (and thereafter as appropriate), displays may include:

....charts comparing lengths, volumes and weights in British system and metric.

....a collection of wrappers and cartons which give contents in the metric system.

....pictures of objects like skiis, film, cultured pearls, etc. which are measured by metric standards.

....local maps, with distances converted into kilometers.

....metric recipes.

History and Geography of Metrics

Pretend you are a caveman and must build a raft. How long? Measure by? (Suggest fingers, hands, cubits What is best? Is this accurate?

Discuss others:

yard - King Charles' nose to middle finger

foot - King Charlemagne's foot

(Several filmstrips available)

1790 - First established in France the word "meter"

1875 - France signed "Treaty of the Meter"/established International Bureau of Weights & Measures

1965 - Great Britain goes metric

1961 - Japan goes metric. It took them 40 years because of war, business, etc., interruptions.

Metrics - Easier - Based on Ten

All the world is metric except the United States, Barbados, Burma, Gambia, Ghana, Jamaica, Liberia, Muscat, Oman, Nauru, Sierra Leone, Southern Yemen, Tonga, and Trinidad.

I. Change various Nursery Rhymes, Song Titles, and Sayings to express metric terms.

1. Nursery Rhyme

Crooked man walked a crooked meter.

2. Song Titles

Sixteen Tons –

Five Hundred Miles -

3. Sayings

A miss is as good as _____ km.

Give her a _____cm and she'll take _____km.

More bounce to _____ gm.

He wouldn't budge _____ cm.

_____gm of prevention are worth _____kg of cure.

II. Write new Metric Sayings using rhyme or alliteration:

Example: More bounce to the ounce.

More wham to the gram.

III. Change these Titles:

20,000 Leagues Under the Sea

Five Foot Two, Eyes of Blue

Fahrenheit 451

High School Math Dept.

We have 1000 centicubes in several colors. (Each is 1 cm x 1 cm x 1 cm.) They can be used in many ways to build lengths, areas, and volumes, not to mention fractions, and ratios.

Teach a unit on conversion within the metric system.

Students learn prefixes, then convert by moving the decimal point appropriately.

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